Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2345883 A1 2002/07/09

(21) 2 345 883

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2001/05/01

(41) Mise à la disp. pub./Open to Public Insp.: 2002/07/09

(30) Priorité/Priority: 2001/01/09 (09/756,203) US

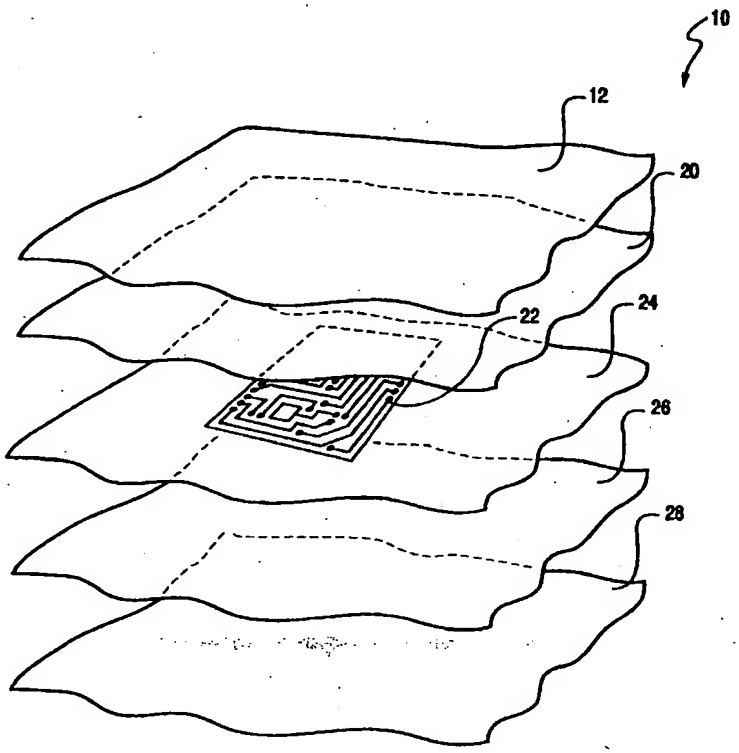
(51) Cl.Int.^{7}/Int.Cl.^{7} G01V 15/00, B32B 7/12

(71) Demandeur/Applicant:
MOORE NORTH AMERICA, INC., US

(72) Inventeurs/Inventors:
HAUSLADEN, MICHAEL C., US;
SHIPSTON, ADELE C., US;
ROGERS, DOUGLAS A., US;
DUFFY, JOSEPH, US;
NASH, THOMAS P., US;
DAVIS, ROBERT K., US;
PALMER, ERIC V., US;
MITCHELL, NANCY G., US

(74) Agent: SMART & BIGGAR

(54) Titre : ETIQUETTE RFID RESISTANT A LA CHALEUR ET AUX LIQUIDES
(54) Title: HEAT AND LIQUID RESISTANT RFID LABEL ASSEMBLY



(57) Abrégé/Abstract:
A high temperature and aggressive liquid environment RFID label adapted to receive thermal transfer or other print to provide indicia on or visible through an outer surface thereof and adapted to be disposed on a part that may be exposed to aggressive and/or high temperature environments. The outer layer of the label is formed from a high temperature resistant material. A barrier coating and/or synthetic material is provided to preclude cleaning solutions from soaking through the exposed surface of the label and destroying the adhesive that holds the tag together and/or holds the label and its associated RFID tag in place on a product.

HEAT AND WATER RESISTANT RFID LABEL ASSEMBLY

ABSTRACT OF THE DISCLOSURE

A high temperature and aggressive liquid environment RFID label adapted to receive thermal transfer or other print to provide indicia on or visible through an outer surface thereof and adapted to be disposed on a part that may be exposed to aggressive and/or high temperature environments. The outer layer of the label is formed from a high temperature resistant material. A barrier coating and/or synthetic material is provided to preclude cleaning solutions from soaking through the exposed surface of the label and destroying the adhesive that holds the tag together and/or holds the label and its associated RFID tag in place on a product.

HEAT AND LIQUID RESISTANT RFID LABEL ASSEMBLY

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a printable label having a radio frequency identification "RFID" tag incorporated therein that is resistant to high temperature decomposition as well as aggressive chemicals such as degreasing solutions, alkaline and acid solutions. Thus, the invention relates to the field of anti-theft and information tags that are incorporated in a label secured to a product. The tags include a relatively thin electronic device to assist in preventing theft and/or to contain product information that can be encoded into a signal for identifying the product when the signal is received by a suitable receiver. The thin electronic device is applied to or laminated between outer layer(s) of the label and an outer surface of the label may be printed with graphics and/or product information. As presently proposed, the invention is embodied in an RFID tag assembly for use in high temperature and aggressive chemical environments.

Electronic (RFID) devices are commercially available and do not per se embody the invention. Early RFID systems were developed utilizing relatively large packages, which limited the products on which they could be used. More recently, RFID devices have been made smaller so that they may be readily incorporated in tags or labels and their use can be more widespread. Such electronic devices are characterized in that they are thin, flat and generally flexible devices that are desirably laminated between outer sheets or layers of the label so that the electronic feature is relatively undetectable by the casual observer. Due to the more widespread use of RFID tags, there has been an increasing interest in developing RFID tags and more specifically labels that can endure moisture and/or heat exposure as may be encountered by the product to which they are applied.

It is an object of the present invention to provide a high temperature and aggressive liquid environment label adapted to receive thermal transfer or

other print to provide indicia on or visible through an outer surface thereof and adapted to be disposed on a part that may be exposed to aggressive and/or high temperature environments.

The foregoing object is realized in accordance with the invention by forming an RFID label as a lamination of a barrier coated face stock or synthetic, printable face stock having an RFID component such as a Rafsec inlet adhered to a surface of the face stock. In an alternate embodiment, coated face stock may be provided on each side of the inlet.

The label adhesive is provided to hold up to extremely high temperatures and soaking in water solutions. Moreover, a barrier coating and/or synthetic material is provided to preclude cleaning solutions from soaking through the exposed surface of the label and destroying the adhesive that holds the label in place. In an exemplary embodiment an article provided by the present invention is a label/tag for automotive electroplate painting and similar such aggressive and/or high temperature environments. Additional embodiments include a label/tag for asset tracking and maintenance records, drum/pallet/tote tracking; and tracking of parts that routinely are washed such as medical devices that are sterilized by autoclaving.

BRIEF DESCRIPTION OF THE DRAWINGS

These, as well as other objects and advantages of this invention, will be more completely understood and appreciated by careful study of the following more detailed description of the presently preferred exemplary embodiments of the invention taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is an exploded, partial, perspective view of a label/tag construction embodying the invention; and

FIGURE 2 is a cross-sectional view of the label/tag construction of FIGURE 1.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides an RFID (Radio Frequency Identification) tag incorporated into a printable label that is resistant to high temperature decomposition characteristics of unmodified paper stock as well as aggressive liquids such as degreasing solutions, alkaline and acid solutions.

A laminated label assembly comprising an embodiment of the invention is schematically illustrated in the exploded, perspective view of FIGURE 1 and in the cross section of FIGURE 2. More specifically, the label assembly 10 is a laminated assembly, comprised of a plurality of layers selected for their chemical and/or temperature resistance. The first, outer substrate layer is a paper layer 12 composed of either a coated temperature resistant paper or synthetic paper that is optionally coated, the temperature resistant paper or synthetic paper being identified by reference number 14, the outer surface coating, which is optional in the case of the synthetic paper, being identified by reference number 16, and the inner surface coating which is limited to the temperature resistant paper alternative, being identified by reference number 18. In an exemplary embodiment, the first, outer substrate is temperature resistant to at least about 400°F.

A layer of adhesive 20 is provided to fasten an RFID inlet 22 in place. This adhesive layer can, but does not necessarily, extend beyond the dimensions of the inlet. An optional coating 24 can be provided to protect the inlet from the chemical environment, particularly in the absence of an optional additional layer of adhesive 26. In the case of a label, the additional adhesive layer 26 is a pressure sensitive adhesive and a release liner, as schematically shown by reference number 28, is provided. In the case of a tag, the adhesive layer 26 is used to hold an optional second layer of coated paper or synthetic paper that is optionally coated, corresponding to the first layer 12, described above, as is also schematically shown by reference number 28.

An example of a tag/label requiring high temperature and aggressive liquid resistance is an RFID tag/label for automobile painting applications. Additional embodiments include a label/tag for asset tracking and maintenance records, drum/pallet/tote tracking; and tracking of parts that routinely are washed such as medical devices that are sterilized by autoclaving. The adhesive must hold up to extremely high temperatures and soaking in water or other cleaning solutions. With conventional paper stocks, the aggressive chemicals in the environment of the tag/label can destroy the surface paper layer and penetrate to the adhesive layer and damage that layer as well. This will cause the label/tag to fall off or apart and lose any optionally printed information on the face stock. Additionally, the paper could stain and become unreadable. The combination of heat and some chemicals could also destroy or make unreadable a traditional unmodified paper stock.

While coated paper stock can be successful for exhibiting resistance to even aggressive liquids, in accordance with the invention, the treated/coated paper also needs to be resistant to high temperature. Accordingly, to provide a treated/coated paper that is resistant to high temperature, special papers such as rice paper are advantageously provided as the printable stock. In the alternative, the printable stock of the label or tag is made from a synthetic material such as, but not limited to, a polyimide, poly(ethylene terephthalate), poly(ethylene Napthalate) or other polymer with temperature resistant properties.

Several constructions have been made and tested in accordance with the present invention and provide advantageously temperature and aggressive liquid resistant printable labels incorporating RFID tags. As noted above, it is an object of the invention to provide a printable label incorporating a RFID tag that is resistant to high temperature decomposition characteristics of unmodified paper stock as well as aggressive liquids such as degreasing solutions, alkaline and acid solution both. To achieve this object, the RFID tag is either captured between the product and a high temperature and aggressive liquid resistant substrate so that the RFID tag is substantially

isolated from liquid contamination or the RFID tag is captured between sheets of high temperature and aggressive liquid resistant material and the laminated assembly may then be applied to the product. The substrates provided in accordance with the invention are liquid resistant so that aggressive liquids such as degreasing solutions or other alkaline or acid solutions cannot penetrate the substrate to the adhesive which would otherwise result in partial or complete delamination of the tag assembly and/or detachment from the product.

The paper face stock is selected to exhibit thermal resistance. Paper stocks able to hold up to temperatures of at least about 200°C for several hours are used. In the presently preferred, exemplary embodiments of the invention, the paper face stock is either rice paper or thermal transfer paper, which are known for their thermal resistance characteristics, but other paper stocks known to have similar properties could be used.

To provide the desired moisture resistance of the label, a barrier coating 16, 18 is coated on the face and/or backside of a paper stock 14 before adhering an RFID inlet 22. In the alternative, a synthetic material is selected that is substantially impermeable to moisture. Where a barrier coating is applied to the paper face stock, the barrier coating can be ultraviolet (UV) or thermal cured. The barrier coating can be based on a number of different chemistries, such as epoxy, silicone, urethane, acrylic, and the like. One of the desired characteristics of the thermosetting or UV cured system is that there be some degree of cross-linking to improve the resistance of the coating to aggressive chemical environments and high temperature. In an exemplary, presently preferred embodiment, the barrier coating(s) 16, 18 extend to the edge of the tag/label 10. Specifically, in an exemplary embodiment, the barrier coating 16, 18 is the size of the adhesive layer 20 and aligned with that adhesive layer. Examples of suitable barrier coatings are Flexocure transparent white, which is UV curable and available from AKZO Nobel Inks, Corporation of Plymouth, MN, or the barrier coating may be water-based Barrier Coating Northwest 200951A available from

Northwest Coatings. The temperature resistant paper face stock 14 is printed before or after the barrier coating 16, 18 if any, is applied. As noted above, the paper layer 14 may be synthetic paper material that is optionally coated as at 16. The coating is optionally applied to improve the printability of the polymer surface. For example, an opaque polyimide (Kapton ® from Dupont) is commercially available and applied optimally for use with impact printers (PMD 8830), as well as for thermal transfer printers (PMD 9930). A coated opaque poly(ethylene terephthalate) is available coated optimally for laser printers form Dura-Tech (Dura-Tex II laser matte).

As noted above, a barrier coating is applied in accordance with the invention and/or an optionally coated synthetic substrate is provided so as to substantially preclude a cleaning solution or other aggressive chemical from soaking through the paper stock and decomposing the adhesive. This will in turn minimize the potential for delamination of the tag assembly and/or detachment of the label from the product.

As noted above, the printable label provided in accordance with the present invention is high temperature and corrosive liquid resistant so that the label will maintain its integrity and remain attached to a product under high temperature conditions and/or when exposed for potentially prolonged periods to aggressive liquids such as degreasing solutions. To provide the requisite temperature resistance, the RFID tag incorporated in the label of the invention is desirably selected from among known temperature resistant RFID tags. Vendors of thin film RFID tags include Checkpoint, Frendenburg, Gemplus, Omron, Poly-Flex, Polymer Flip Chip, Rafsec, SCS and Texas Instruments. Rafsec provides their inlets coated with polymer or with paper. However, almost every other manufacturer does not do this.

As noted above, to provide corrosive liquid resistance for the printable label of the invention, a substrate selected and/or treated for aggressive liquid resistance is provided to shield the RFID tag and associated adhesive from the aggressive liquid environment. In a first embodiment of a label according

to the invention, a first, outer sheet or substrate is provided so that the RFID tag (hereinafter generically referred to as inlet) will be captured between the product and the substrate so that the inlet is effectively encapsulated between the product and the first, outer paper stock or substrate. The substrate provided in accordance with this embodiment is selected for high temperature resistance and aggressive liquid resistance. In one exemplary embodiment, the substrate 12 comprises paper 14 that is resistant to high temperature, such as rice paper. The rice paper of this embodiment has a coating 16, 18 applied to outer (print) and inner faces thereof and an adhesive 20 applied to the inlet/product side thereof. A sheet of release paper, schematically shown by reference number 28 is desirably provided to shield the adhesive 20 prior to application of the label. A further adhesive layer 26 may optionally be provided between the inlet 22 and the release paper to facilitate secure adhesive attachment of the label 10 to a product.

As noted above, in a presently preferred exemplary embodiment, the coating is a Flexocure coating, which is a UV cured acrylic material. Flexocure is preferred due to its excellent properties for coating with typical coating equipment. Flexocure coated rice paper can be exposed to temperatures of about 200°C for a few hours and is independently resistant to aggressive liquids/chemicals.

In a preferred embodiment, the adhesive 20 and/or adhesive 26 is thermosetting or pressure sensitive and resistant to aqueous solutions and temperature. An example of a thermosetting adhesive would be an epoxy. For this construction, a pressure sensitive adhesive is preferred because it allows the joining of the inlet and other layers of the label/tag to be achieved more reliably. An acrylic adhesive is preferred. Examples of suitable commercially available, heat resistant adhesives include the 941N laminate available from 3M, P95 adhesive available from National Starch, and the Swift 2R693 adhesive available from Reichold.

For applications where, rather than an adhesively attached label, the label assembly is defined as a tag, the inlet 22 is captured between the optional coating 24 and the face stock 12. In an alternate embodiment of the invention, rather than or in addition to optional coating 24, the face stock 12, which defines the print face of the tag, and an inner substrate 28 are provided so as to capture the inlet 22 therebetween. The inner substrate 28 generally corresponds to face stock 12, being selected so as to be aggressive chemical resistant and high temperature resistant. Thus, in a preferred tag embodiment, the inner substrate comprises a second layer of coated temperature resistant paper or synthetic paper that is optionally coated.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A heat and liquid resistant RFID label assembly, comprising:

an RFID tag structure having a first, outer face and a second, inner face;

a first, outer substrate, said outer substrate being heat resistant to at least about 400 degrees Fahrenheit and being substantially impermeable to liquids;

said outer substrate being secured to said first surface of said RFID tag so as to project from peripheral edges thereof, whereby when the assembly of the outer substrate with RFID tag secured thereto is applied to a product with said inner surface of said RFID tag facing the product, said RFID tage is substantially encapsulated between said outer substrate and the product.

2. A label assembly as in claim 1, further comprising a second, inner substrate secured to said second surface of said RFID tag, thereby to define a tag.

3. A label assembly as in claim 2, wherein said second, inner substrate is heat resistant to at least about 400 degrees Fahrenheit and is substantially impermeable to liquids.

4. A label assembly as in claim 3, wherein said inner substrate comprises rice paper.

5. A label assembly as in claim 2, wherein said inner substrate is at least one of treated and coated so as to be substantially impermeable to liquids.

6. A label assembly as in claim 5, wherein said inner substrate is coated with a Flexocure coating.

7. A label assembly as in claim 2, wherein said inner substrate is a synthetic material that is heat resistant and substantially liquid impermeable.

8. A label assembly as in claim 7, wherein said synthetic material is selected from the group consisting of polyimide, poly(ethylene terephthalate), poly (ethylene Napthalate), and polyether imides.

9. A label assembly as in claim 8, wherein said synthetic material is selected from the group consisting of Kapton and Dura-Tex II.

10. A label assembly as in claim 1, wherein said outer substrate comprises rice paper that is at least one of treated and coated so as to be substantially impermeable to liquids.

11. A label assembly as in claim 10, wherein said outer substrate is coated with a Flexocure coating.

12. A label assembly as in claim 1, wherein said outer substrate is a synthetic material that is heat resistant and substantially liquid impermeable.

13. A label assembly as in claim 12, wherein said synthetic material is selected from the group consisting of polyimide, poly(ethylene terephthalate), poly (ethylene Napthalate), and polyether imides.

14. A label assembly as in claim 13, wherein said synthetic material is selected from the group consisting of Kapton and Dura-Tex II.

15. A label assembly as in claim 1, wherein said first surface of said RFID tag structure has a layer of adhesive disposed thereon.

16. A label assembly as in claim 1, wherein said second surface of said RFID tag structure has a layer of adhesive disposed thereon.

17 A label assembly as in claim 1, wherein said second surface of said RFID tag structure has a chemical resistant coating applied thereto.

18. A label assembly as in claim 17, wherein said outer substrate comprises rice paper that is at least one of treated and coated so as to be substantially impermeable to liquids.

19. A label assembly as in claim 18, wherein said outer substrate is coated with a Flexocure coating.

20. A label assembly as in claim 13, wherein said outer substrate comprises a Kapton with white pigment having a printable surface and a pressure sensitive acrylic adhesive that is stable to 450 °F and tacky at room temperature so as to permit lamination of the assembly.

& Biggar
Ottawa, Canada
Patent Agents

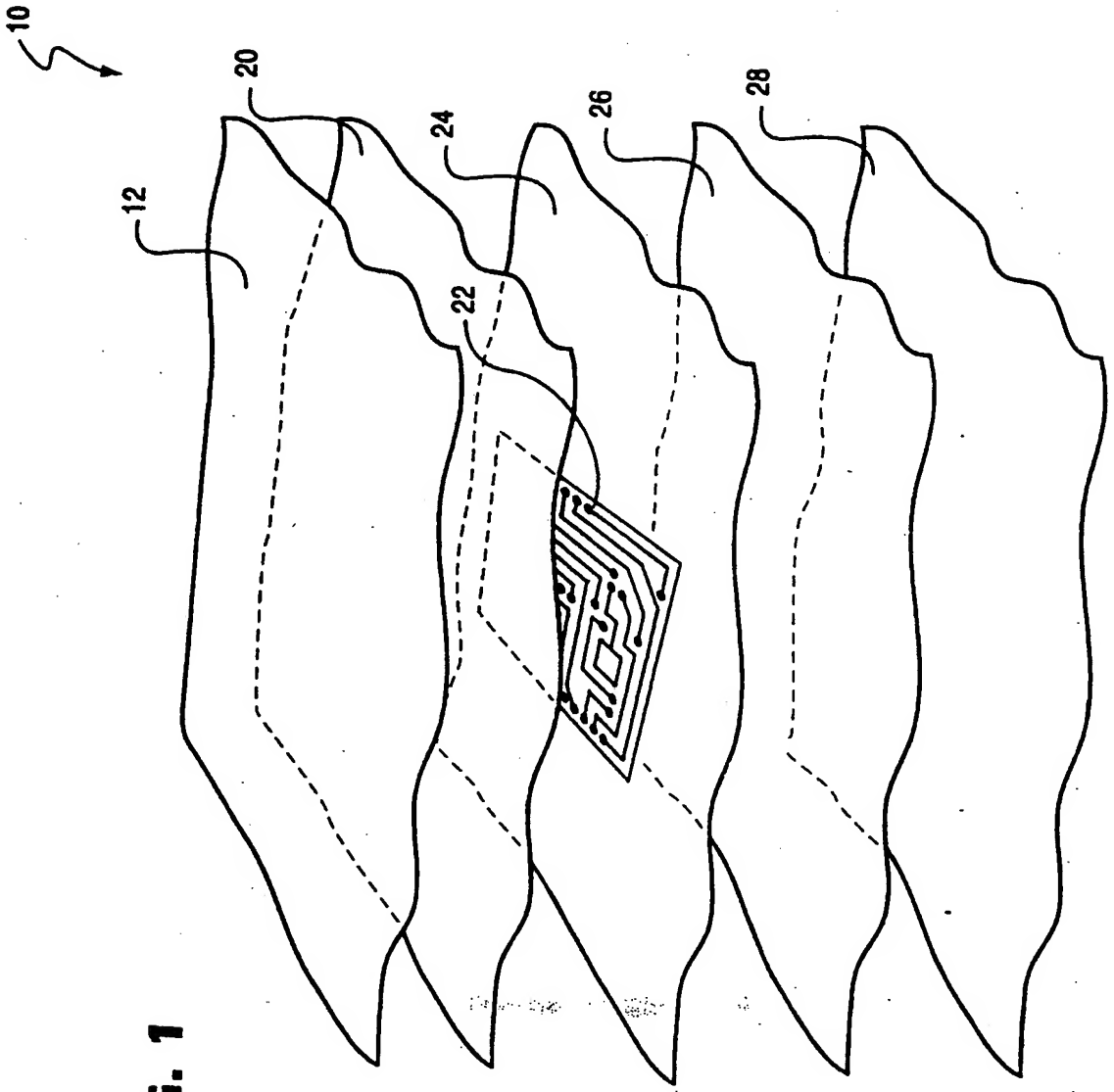
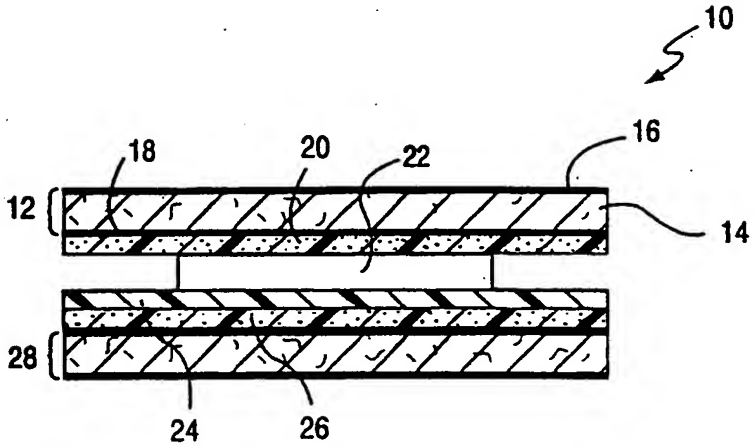
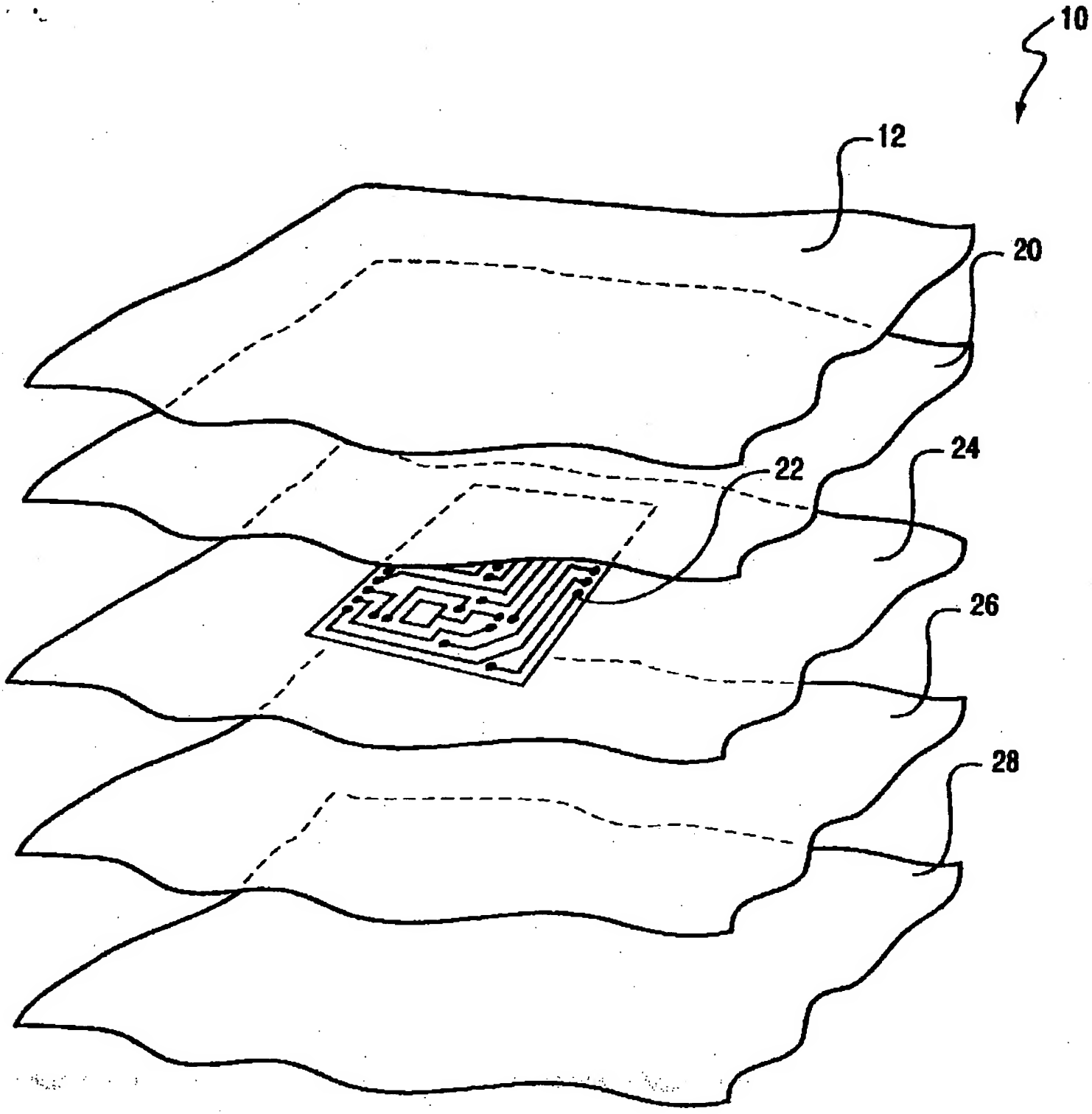


FIG. 1

FIG. 2




10
12
20
22
24
26
28